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ABSTRACT

This module is one of five modules on length, area, volume and capacity, mass, and temperature, developed for the use of teachers and teacher-trainer team leaders. Primary and intermediate activities in this booklet concentrate on the concept of length with emphasis on metric measurement. The objectives and needed materials for each activity are listed. (MN)

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ALBANY-SCHOHARIE-SCHENECTADY BOCES

PROJECT:

"METRIC EDUCATION: WE ARE GETTING READY FOR THE CHANGE"

MODULE ON LENGTH

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1977

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INTRODUCTION

This module on length is one of the five modules, on length, area, volume and capacity, mass, and temperature, developed, for the use of teachers and teacher-trainer team leaders, as a product from the Project "Metric Education: We Are Getting Ready For The Change."

Parts of this module were developed and tried during the recent workshops conducted for the BOCES level team leaders. Participants of these workshops made a significant contribution in the development of this module.

The activities incorporated in this module are only suggestive in nature and teachers are free to modify them according to their classroom needs.

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General: Length

Length is the most common measurement we make in our day-to-day living. Meter is the base unit of length measurement, and, all other units of length used to measure larger or shorter lengths are simple decimal multiples of this base unit meter. More commonly used units, besides meter, are kilometer, centimeter and millimeter. You may like to use the following units:

Prefix	Base Unit	Name	Symbol	Relation to other Units
kilo	meter	kilometer	km	1 000 meters
hecto	meter	hectometer	hm	100 meters
deka	meter	dekameter	dam	10 meter
	meter	meter	m	1 meter
deci	meter	decimeter	dm	0·1 meter *a
centi	meter	centimeter	cm	0·01 meter *b
milli	meter	millimeter	mm	0·001 meter *c

[a] one-tenth of a meter; 1 m - 10 dm

[b] one-hundredth of a meter; 1 m = 100 cm
1 dm - 10 cm

[c] one-thousandth of a meter; 1 m = 1000 mm
1 cm = 10 mm

It is important for children to understand the basics of metrics but every child does not necessarily need all the metrics (symbols, prefixes, base units and derived units). Allow children to learn only those terms and practices which are necessary for their daily use, and from this familiarity let the children expand their range of use of the metric system.

Children may be advised of the following pattern: (a) to change from a smaller metric unit to a larger metric unit, you divide, that is move the decimal point to the left; and (b) to change from a larger metric unit to a smaller metric unit, you multiply, that is, move the decimal point to the right.

SECTION 1

PRIMARY

OBJECTIVE 1: Select objects that are longer than, shorter than or the same length as a given object.

MATERIALS: Common classroom objects of various lengths: chalk, board erasers, pencils, pens, strips of paper, etc.

ACTIVITY: Place the objects and three small boxes labeled "longer than", "shorter than", and same length as" on a table. Read the labels for the children if necessary. Select an object to be used as the given object. Have a student come to the table and sort the remaining objects into the boxes. The sorting may be done by just visual comparison or it may be done by physically comparing the lengths of the objects. The player(s) with the most correct comparisons is (are) the winner(s).

VARIATION: Same type of activity except the objects are on cards and the children play comparing games. For example, a game could deal with "longer than" and each player turns over two cards. The player with the card showing a longer object keeps the two cards. The winner is the player with the most cards at the end of a given time. This could also be played as a concentration game.

* * * *

OBJECTIVE 2: Uses arbitrary (non-standard) units for measuring length.

MATERIALS: (Repeat from objective #1 above)

ACTIVITY: Allow students, one, two, three at a time, to come to a table where the objects are displayed. Provide the students with a non-standard unit for measuring-short paper, regular paper clip or a long paper clip. Have the students measure a selected number of objects and record the lengths. If they are not able to record the answers have them verbalize the length. Ask them to use the word "about" in describing the lengths.

VARIATION: Have the students measure longer objects in the classroom by using handspans, their shoes, etc.

* * * *

OBJECTIVE 3: Uses a meter-centimeter ruler.

MATERIALS: One or more meter-centimeter rulers (one meter in length)

ACTIVITY: Have the students work in pairs - one student measures, one student records (you may want to develop a record-keeping sheet) or verbalizes the results. Objects to measure would include desks, tables, counters, doors, chalkboards, etc. The student will give the answers as meters or as meters and centimeters. Again, allow the use of the word "about" in giving the lengths.

VARIATION: Have the students measure pre-cut pieces of string or twine.

OBJECTIVE 4: Using meter-centimeter tape

MATERIALS: Meter-centimeter tape

ACTIVITY: Record of your personal measurement

NAME: _____ AGE: _____

	OBJECT	ACTUAL MEASURE TO THE NEAREST CENTIMETER
1.	Your height	___ cm
2.	Around your chest (shirt/blouse size)	___ cm
3.	Around your neck (collar size)	___ cm
4.	Around your waist (belt size)	___ cm
5.	Around your head (hat size)	___ cm
6.	Length shoulder to wrist (sleeve length)	___ cm
7.	Length waist to ankle (slack size)	___ cm
8.	Length heel to toe (shoe size)	___ cm
9.		___ cm
10.		___ cm
11.		___ cm
12.		___ cm

OBJECTIVE 5: Measure the heights of his peers in centimeters.

MATERIALS: Meter-centimeter rulers (meter long) or 150 centimeter measuring tape.

ACTIVITY: Have students work in teams of three....one to measure, one to record, one to be measured. The student to be measured should stand in front of the chalkboard and the student measuring should make a mark at the top of his head and then measure the distance from the floor to this mark in centimeters. The third student records the height. The students switch roles and repeat the process.

VARIATION: Have each row (or table make a centimeter tagboard strip) long enough to measure each person in the row. The tag board should be about ten centimeters wide. The strip is then taped to the wall. Each student in the row stands in front of the strip and the other students give his height in centimeters.

* * * *

OBJECTIVE 6: Measures lengths in whole centimeters (lengths less than 50 centimeters) Worksheets for students to record results.

MATERIALS: (Objects from objective #1; add books, notebooks) Also 30 centimeter rulers.

ACTIVITY: Allow each student to use a ruler to measure several or all of the above objects. Provide a worksheet for the students to record their results. Review the procedure for using the ruler and allow students to verbalize that an object is "about" centimeters. Encourage students to measure the lengths of their fingers and their handspan.

VARIATION: Allow students (one-at-a-time) to come to a table, measure an object in centimeters, select a previously prepared index card give the correct measurement and then place the card on the object.

* * * *

OBJECTIVE 7: Estimate lengths in centimeters.

MATERIALS: Objects similar in length to those listed in objective #5.

ACTIVITY: The teacher holds up an object and asks the students to record an estimate of its length. After the students have recorded their estimates, a student comes to the front of the room, measures the length of the object and states its length. The other students record the length next to their estimates. The students with the closest estimate is(are) declared the best estimater(s). Repeat the procedure with the other objects.

VARIATION: The teacher holds up three objects of different length (the lengths should differ by four or five centimeters) and states that she is thinking of an object that is __ centimeters long. The students guess the object.

OBJECTIVE 8 Using a centimeter ruler.

MATERIALS: Centimeter ruler

ACTIVITY: Measure the following line segments using a centimeter ruler to the nearest centimeter.

	Line Segments	Length to the nearest centimeter
1.		12 cm
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

* * * * *

OBJECTIVE 9: Measures lengths in meters and centimeters (lengths greater than two meters)

MATERIALS: Metric tape measure - at least ten meter tape, preferably 30 meter tape.

ACTIVITY: Have the students work in threes....two to measure and one to record. The students switch roles after each measurement. The students measure longer things such as the length and width of the room, the height of the room (with teacher assistance) the length and width of corridors in the school, the length and width of the gym, etc. Each length is given as ____meters or _____meters and _____centimeters. After all teams are finished, they discuss their results in order to justify their accuracy.

* * * *

OBJECTIVE 10: Measures perimeters of given objects in centimeters.

MATERIALS: 30 Centimeter rulers, geometric figures cut out of construction paper...triangles, squares, rectangels, pentagons, etc.

ACTIVITY: Pass out a set of geometric figures to each student. Students should measure the length of each side of the first figure and record and along the appropriate edge. When the measures are completed the students should list them (vertically) near the center of the figure and add. The results should be discussed and perimeter reviewed if necessary. The students should repeat the procedure for the other figures.

VARIATION: Select various textbooks, notebooks, shoeboxes, etc. The above procedure should be followed for each object or for each face of a box. A ditto should be provided in order to assist the students in organizing their measures and then computing the perimeter.

OBJECTIVE 11: Uses meter to measure length.

MATERIALS: String and paper for charts.

ACTIVITY: With kindergarten or first grade students, develop a "Measure Hunt". Students should search and find different objects and measure them for size. Students should record on paper or charts.

* * *

OBJECTIVE 12: Shows ability to use a metric centimeter ruler.

MATERIALS: Metric rulers.

ACTIVITY: Each student will measure various objects in classroom.

desk _____ cm

pencil _____ cm

book _____ cm

* * *

OBJECTIVE 13: Identifies the relationship among metric prefixes.

MATERIALS: 5 x 8 cards - with the 6 prefixes printed (kilo, hecto, deka, deci, centi, milli)

ACTIVITY: Using the cards have each student place them in order, from largest to smallest.

* * *

OBJECTIVE 14: Shows ability to read a metric ruler.

MATERIALS: Metric rulers.

ACTIVITY: Have classroom develop a collection of things to measure for length. Fill a large decorated "metric box" with: rope, ribbon, pencils, scarves, tickets, straws, nails, clothespins, etc. Students will take guest adventure to measure all articles in box in as many different metric measures.

* * *

OBJECTIVE 15: Makes a picture by adding the directed missing part.

MATERIALS: Pencil and metric cm ruler.

ACTIVITY: Students will enjoy coloring and finishing the different pictures in this activity.

Draw a stem on the flower. Make it 6 cm long.

Draw a stick on the lollipop. Make it 8 cm long.

Draw a straw in the glass. Make it 5 cm long.

Draw a tail on the dog. Make it 3 cm long.

OBJECTIVE 16: Makes a picture from directed cm measures.

MATERIALS: Metric cm ruler.

ACTIVITY: Students enjoy drawing pictures. They should have little difficulty finishing this picture.

Finish "Thin Tim" by following the given directions:

Draw a mouth 2 cm long.

Draw a nose 1 cm long.

Draw the left arm 5 cm long.

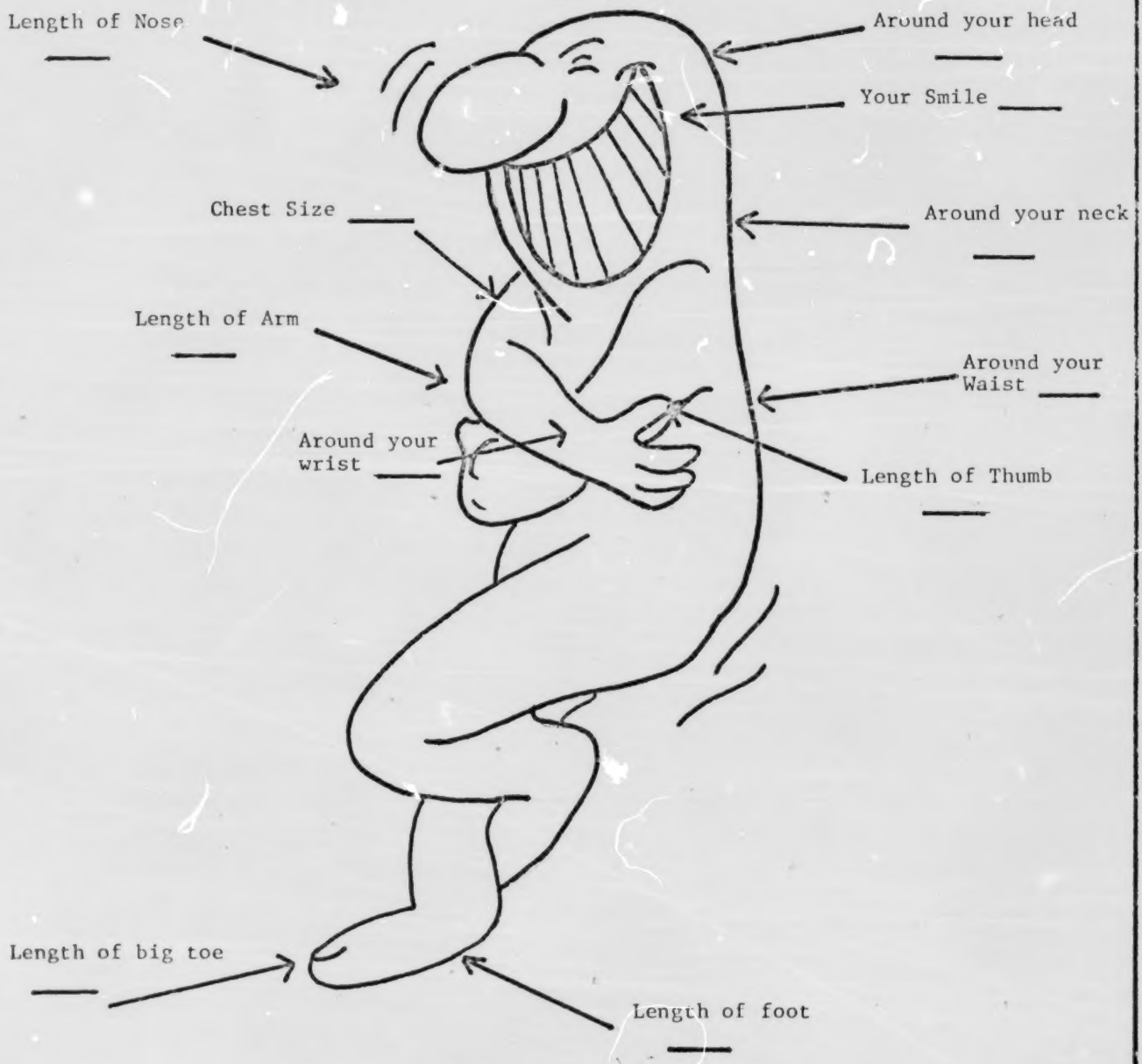
Draw the left leg 6 cm long.

Draw five 1 cm fingers.

OBJECTIVE 17: The student will be able to measure using cm units.

MATERIALS: Meter string and metric ruler.

ACTIVITY: Have students follow worksheet which records self measurement.
Students should discover that 2 x your wrist = your neck
2 x your neck = your waist
The human body has mathematical proportions if one treats it well! After measuring with string calculate with metric ruler.



SECTION 2

INTERMEDIATE

OBJECTIVE 1: Measures lengths in meters, centimeters and millimeters.

MATERIALS: Objects to be measured in centimeters and millimeters (lengths less than 10 cm).
Objects to be measured in meters (centimeters and millimeters if necessary).
Metric measuring tapes (100 cm to 30 m)

ACTIVITY: Have students measure several of these objects and record their lengths as __ meters __ centimeters and __ millimeters. Stress that any measure can be stated (using the largest measure) as "about __(unit)". Point out that using consecutively smaller units improves the accuracy of the measure.

* * * * *

OBJECTIVE 2: Selects appropriate units for recording measures of length.

MATERIALS: Ditto listing several lengths to be measured. Next to each length is a blank for recording the name of an appropriate unit.

ACTIVITY: Have the students measure several things inside and outside the classroom. Discuss their measures ... for example, a measure could be 5 meters, 500 centimeters, 5000 millimeters, etc. ... and the appropriateness of each of the ways to write a given measure. Next, hand out the ditto and have the students select the most appropriate unit for measuring each length.

* * * * *

OBJECTIVE 3: Measures perimeters in centimeters and millimeters.

MATERIALS: Several geometric shapes (squares, triangles, rectangles, pentagons, etc.) cut out of construction paper. (Each side less than 30 centimeters.)

ACTIVITY: Pass out the figures, have the students measure each side of the first figure and record the measure doing each edge. Finally, the students record the measures (vertically) at the center of the figure, add and make any necessary conversions.

VARIATION: Use real objects from the classroom (books, etc.), repeat procedure, record and add on a ditto sheet.

OBJECTIVE 4: Using a meter-centimeter ruler/tape.

MATERIALS: meter-centimeter ruler and tape.

ACTIVITY: Before you measure an object, guess its length, width, height, diameter, distance (as the case may be) in meters (to the nearest meter); record your estimate and then measure the object.

Object to Measure	Your Estimation Nearest Meter	Actual Measure Nearest Meter	Difference
1. Length of this room	8 meters	9 meters	1 meter
2. My height			
3. Height of this room door			
4. Length of this table			
5. Width of this room			
6. Height of the chalkboard			
7.			
8.			
9.			
10.			

Practice should be given in the use of a tape measure especially when the objective is to measure objects like "distance around your waist", "neck measure", etc.

* * * * *

OBJECTIVE 5: The student will be able to recognize and use standard metric units of length.

MATERIALS: Handmade metric rulers

ACTIVITY: Organize students in groups of 3 or 4 to measure assigned measurement tasks.

1. Measure things in room.

2. Measure inside and outside of school.

OBJECTIVE 6: Records lengths expressed in meters, centimeters and/or millimeters in decimal notation.

MATERIALS: Objects to be measured; ditto sheet to assist students in recording results and conversions.

ACTIVITY: Have students measure the smaller objects (less than 50 centimeters in length) and express the results as __cm __mm. Discuss the fact that a millimeter is 1/10th of a centimeter and rewrite the lengths as __._ cm. Repeat the procedure with the longer objects . . . express the lengths first as __m __cm and then rewrite the lengths as __._ meters. Review the results, particularly stressing why the first set of decimals is in tenths and the second set is in hundredths.

VARIATION: Repeat the above procedure except have the students record the lengths, first as decimals then in terms of larger to smaller.

* * * * *

OBJECTIVE 7: Finds (discovers) the relationship between the circumference and the diameter of a circle.

MATERIALS: Several tagboard circles, diameters from 2 to 20 cm.
String
Ditto designed to assist students in recording and organizing results.

ACTIVITY: Distribute several circles to each student (if possible). Also, provide each student with a piece of string that is greater in length than the circumference of the largest circle. Each circle should have the center point clearly identified. Next, have the students select a circle, use the string and a centimeter-millimeter ruler to find the length of the circumference and diameter in millimeters, and record the results on the ditto sheet in the form $\frac{C}{D} = \frac{\quad}{\quad}$. Repeat the procedure for the other circles. When all results have been completed, have the students divide C by D and record the results to the nearest hundredth (to the nearest whole number or tenth may be the limit to their division capabilities). When all results are recorded, discuss the results and lead the students to discover the ratio as 3, 3.1, 3.14, etc., depending on this students development in decimals and division.

VARIATION: Repeat the above procedure using tin cans and bottles of varying diameters.

OBJECTIVE 8: State the relationship between kilometer, hectometers, dekameter and meter.

MATERIALS: 30 meter measuring tape -- a 100 meter (1 hectometer) tape is even better.
Ditto sheets for recording results.

ACTIVITY: On the ditto sheet list several lengths (preferably 10 meters to a kilometer) to be measured. Have the students work in groups of three -- two to measure, one to record -- students switch roles after each measurement. After all measurements are recorded, discuss in detail procedures for writing their measurement in several different forms. For example, suppose one measurement is 115 meters. Show how this may be written as 11 dekameters 5 meters . . . 1 hectometer 15 meters . . . or 1 hectometer 1 dekameter 5 meters. Review the 10:1 ratio in moving from meters --- dekameters --- hectometers --- kilometers, and then by reversing the units show the 1:10 in moving from kilometer --- hectometer --- dekameter --- meter. When these relationships have been established, then develop the following relationships: kilometer to dekameter, kilometer to meter, hectometer to meter and then reverse each relationship.

* * * * *

OBJECTIVE 9: Draws line segments of specified lengths . . . lengths given in centimeters and millimeters.

MATERIALS: Centimeter-millimeter rulers (30 cm in length)
Ditto with several line segments of various lengths

ACTIVITY: Preview the procedures for reading a centimeter-millimeter ruler . . . discuss subdivisions and various ways to read (or write) a given length. For example, a length may be 7 centimeters, 8 millimeters or 78 millimeters. Distribute the ditto and have the students measure the line segments . . . giving the lengths as __ cm __ mm and __ mm. Next, distribute blank sheets of paper and have the students draw line segments of specified lengths . . . be sure to designate lengths using both forms: __ cm __ mm and __ mm.

VARIATION: Same type of procedure except students measure real objects and then draw line segments (of specified length) on the chalkboard.

OBJECTIVE 10: Identifies each metric relationship from one prefix to another.

MATERIALS: OAK Tag paper - construct BINGO cards. Chips for markers.

ACTIVITY: Give each student metric BINGO card. Have students place chips on metric equivalents.

Ex: 50 cm = 5 dm

* * * * *

OBJECTIVE 11: Game: Treasure find.

MATERIALS: Trindle wheel, metric rulers, meter sticks

ACTIVITY: Hide a "treasure" Draw a map or give directions using metric measurements. Have students draw a map and give directions for finding treasure.

* * * * *

OBJECTIVE 12: Selects appropriate metric units for recording measurements of lengths.

MATERIALS: Metric rulers, meter sticks.

ACTIVITY: Have students metricate school inside and outside. Use posters and design new signs that will be changed when we go metric.

* * * * *

OBJECTIVE 13: Relates to the 100 meter dash.

MATERIALS: Time watch, metric tape measure.

ACTIVITY: Measure off a distance of 100 m outside. Designate a helper to stand and start runners at beginning of 100 m dash.The teacher will stand at the finish line with stop watch. Each classmate will run the 100 m dash and the teacher will record each running time.
When all students have run the 100 m dash from your data determine the winner.
Solve such problems as: what was the average time for the class? Can boys run faster than girls? How much faster was the fastest runner to the slowest runner?
Make a metric bulletin board with your collected information.

OBJECTIVE 14: Estimates lengths in meters and centimeters

MATERIALS: Meter sticks, 10 meter measuring tapes
Classroom objects
Ditto sheet

ACTIVITY: On the ditto sheet list ten-fifteen classroom objects that the students should use in estimating length . . . desk, length and width of table, chalkboard, width of room, etc. Have the students estimate the lengths of the first five objects and record the estimates on the ditto sheet. Next, allow the students to measure the objects and record the results next to their estimates. Discuss the estimates . . . are you always too long? too short? or are your errors random? Point out objects that are about 1 cm, 10 cm, 50 cm, 1 m, 2 m, etc. After reviewing some simple procedures for estimating, follow similar procedure for the other objects listed on the ditto. Check to see if students have improved their estimating skills.

FOLLOW-UP: Have students select ten objects that are commonly used in their homes and follow a procedure similar to the above in estimating their lengths in meters and centimeters.

* * * * *

OBJECTIVE 15: The student will be able to identify scale measurement in metrics. 1 cm = 1 km.

MATERIALS: cm ruler, paper, pencil.

ACTIVITY: Students will measure the various parts of a map and identify the distance according to a given metric scale 1 cm = 1 km.

This road map is drawn to a scale of 1 cm = 1 km. In km, how far is it from:

1) Jamaica Road to Donna Lane?
2) Donna Lane to Gansevoort Road?
3) Donna Lane to Bluebird Road?
4) Bluebird Road to Terry Drive?
5) Bluebird Road to First Street?
6) Jamaica Road to Gansevoort Road?

QUEST: If you traveled 20 km per hour, how long would it take to make a trip from Jamaica Road to the end of Donna Lane?